Institute of Space Sciences

EXCELENCIA MARÍA DE MAEZTU

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A bayesian methodology for primordial power spectrum non-parametric reconstructions from galaxy clustering

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We present a non-parametric methodology to reconstruct the primordial power spectrum $P_{\mathcal{R}}(k)$ from Large Scale Structure (LSS) data using Bayesian inference and nested sampling. We apply the method to two different classes of objects, one at low-z (ELGs) and one at high-z (QSOs), and two different photometric errors. The clustering of these objects is derived from different templates of the primordial power spectrum motivated by models of inflation: the Standard Model power law characterized by the two parameters A_s and n_s; a local feature template; and a global oscillatory template. Our reconstruction method involves sampling N knots in the log $\{k, P_{\mathcal{R}}(k)\}$ plane. We use two statistical tests to examine the reconstructions for signs of primordial features: a global test comparing the evidence ratios and a novel local test quantifying the power of the hypothesis test between the power law model and the marginalized probability over N-knots model. We discuss the performance of the method for a fixed and for a varying cosmology. The S/N of the observed power spectrum of the studied catalogues and the inclusion of the cosmological parameters H_0, Ω_b and Ω_c to be sampled determines the sensitivity of the method to detect features, which can provide realistic estimations when applied to real data. The method is model independent, flexible, and suitable for its application to existing and future large surveys of the LSS, as Euclid.

Primary author(s) : MARTINEZ-SOMONTE, Guillermo (Instituto de Física de Cantabria (IFCA,UC-CSIC)); Dr MARTÍNEZ-GONZÁLEZ, Enrique (Instituto de Física de Cantabria (IFCA-CSIC)); Dr MARCOS-CABALLERO, Airam (Instituto de Física de Cantabria (IFCA-CSIC)); Dr CAÑAS-HERRERA, Guadalupe (European Space Agency/ESTEC - Lorentz Institute for Theoretical Physics, Leiden Universitylands)

Presenter(s) : MARTINEZ-SOMONTE, Guillermo (Instituto de Física de Cantabria (IFCA,UC-CSIC))

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